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IRP 82-02

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SUMMARY OF
EVALUATION OF THE EXPLORATORY STAGE
OF THE U.S. ARMY TOXIC
AND HAZARDOUS MATERIALS AGENCY
CONTAMINATION SURVEY AT TOOEELE
ARMY DEPOT; TOOEELE, UTAH

CONTRACT NO.: DAAC49-81-C-0192

Ertec

The Earth Technology Corporation

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CONTRACT NO.: DAAC49-81-C-0192

Submitted to:

TOOELE ARMY DEPOT
PROCUREMENT DIVISION
P.O. BOX D
TOOELE, UTAH 84074

AND

U.S. ARMY TOXIC AND HAZARDOUS
MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

Prepared by:

KEVIN T. BLOSE
ERIC G. LAPPALA
KAREN F. KNIRSCH
SIM D. LESSLEY
ROBERT L. STOLLAR

for

ERTEC WESTERN, INC.
3777 LONG BEACH BOULEVARD
LONG BEACH, CALIFORNIA 90807

SUMMARY PRESENTED
SEPTEMBER 21, 1982

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1.0 EXECUTIVE SUMMARY

This report documents the Exploratory Stage environmental survey conducted at the Tooele Army Depot, Tooele, Utah, as described by Contract Number DAAG49-81-C-0192 issued by the Procurement Division, TEAD, under direction of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). The objective of this survey is to determine whether contaminants are present in a vector crossing the installation boundary or are present at a source where the contaminants have a potential to cross the boundary.

The TEAD consists of two separate areas, the North Area, approximately 39 square miles located in Tooele Valley, and the South Area, approximately 30 square miles located in Rush Valley.

Ertec's assessment of the contamination potential for approximately 50 sources in the two areas was derived from information obtained from 7 existing wells, 24 new wells and bore holes, 9 surficial soil and sediment samples, and 6 surface water samples.

The approach to completing the assessment consisted of two phases. Phase I utilized existing data and preliminary site visits to determine sites having the greatest potential to contaminate the subsurface and surface environments at TEAD. This phase resulted in a matrix that relates approximately 100 potential contaminants to 86 potential sources of contamination. This matrix was utilized in conjunction with a hazard ranking system to select sites for field investigation. Phase II comprised the sampling of soil, sediment and water and the analyses for contaminants identified in the contamination matrix for these sites. This was accomplished during the period February 1982 to July 1982.

The methodologies used to collect and analyze samples, install monitoring wells, and obtain magnetic, gravity, seismic, and resistivity results for the geophysical surveys, were carefully designed to provide reliable and accurate information, and were closely followed in the field. Quality assurance procedures ensured the accuracy and reliability of the collected data. Safety procedures designed by Ertec and reviewed by USATHAMA and the TEAD Safety Division were followed by all Ertec and subcontractor employees while engaged in all project-related work.

Because of the unexpected difficulty in drilling in the North Area, the problems associated with winter field conditions, and the attempt to provide for a more cost-effective program, modifications have been made in the original field program. These modifications, approved by USATHAMA, included deletion of several wells, addition of other wells, chemical analysis methodology changes, and data management changes.

The field program began with geophysical surveys in the North Area because of the discovery of what could be a buried bedrock ridge running through the area. This ridge would have a serious impact on the movement of ground water and contaminants from such sources as the Industrial Waste Pond, the Sewage Lagoon, and the TNT Washout Area. A preliminary study using the gravity technique was designed and conducted as the most cost effective procedure for obtaining verification of the hypothesized ridge. Results indicated a ridge was indeed present and very likely

would affect ground-water movement, particularly in the vicinity of the Industrial Waste Pond. Consequently, seismic refraction and electrical resistivity studies were designed to "fine tune" the gravity survey, determine the subsurface structure of the bedrock ridge, and provide hydrogeological information in the area. Preliminary to the actual field program, a blast test was required by Mr. Dave Jackson of the Depot Safety Division and by the Ammunition Surveillance Division because of the stability problem of ammunition stored in some of the igloos. Results of the blast test modified the design of the seismic study.

The drilling operations commenced in January and lasted into June. Magnetic surveys were used to clear sites for unexploded ordnance and buried drums prior to drilling. Ten wells or borings were drilled in the North Area and 14 drilled in the South Area. Soil, sediment, surface water and ground-water samples were collected and analyzed during this period. The evaluation of data obtained from drilling, sampling, and chemical analyses resulted in 1) definition of the occurrence of ground water including perched zones, mounds, discharge and recharge areas, regional, and local hydrogeology, 2) definition of contaminants discovered at each sampling site, and 3) determination of problem areas where contaminants have the potential to migrate or are migrating off the Depot.

All chemical analyses for contaminants identified with the contamination matrix were performed by the Utah Biomedical Testing Laboratory (UBTL) in Salt Lake City. Under this project, UBTL was certified for both qualitative screening of contaminants and semi-quantitative analyses. UBTL developed new and adapted existing analytical methods during this project. Semi-quantitative

values are included in this report for samples taken during Phase II. Because of the method used for extending laboratory certification to the semi-quantitative range, information has been obtained that can be used to estimate not only the presence, but the degree of contamination, at a cost savings to the government and without compromising the reliability of the results.

Ertec has defined three areas in which contamination of the ground water has occurred--two in the North Area, one in the South Area. Ground-water contamination in the Headquarters Area is caused by seepage of contaminated water from two sources, the Industrial Waste Pond and the Sewage Lagoon. The Industrial Waste Pond has caused the development of a contaminated perched zone. Contaminated ground water from this source has the potential of migrating toward the Depot's north boundary and toward Depot water supply Well 1. The complex hydrogeology of the area has further complicated matters. Bedrock contamination in this area may result in long-term seepage of contaminants into the regional unconsolidated aquifer. Leakage from the Sewage Lagoon has produced a contaminated ground-water mound. Ground water from this mound has the potential to migrate towards the north boundary and towards Depot water supply wells. Effluent from the outfalls originating in the Maintenance Area in the North Area may contribute significantly to this problem.

The second problem area discovered in the North Area occurs at the TNT Washout Ponds/Laundry Effluent Ponds. High levels of explosives have been discharged over an unknown areal extent and have been detected in soil down to 100 feet. Contamination of the ground water by RDX and TNT degradation products has occurred by downward percolation of TNT washout pond water; nitrates have been found up to 6 times the EPA water quality criteria standards. Flooding of

the contaminated area by contaminated laundry effluent is a continuing mechanism of contaminant transport to the ground water.

The South Area is relatively clear except for high arsenic levels found in the south and southeast portions of the site. Extremely high arsenic levels, up to almost 20 times the EPA water quality criteria standards, have been found on the south boundary, and are undoubtedly migrating off the Depot property. The exact source of the arsenic is not known, but may be from unrecorded lewisite disposal in the Demilitarization Area/Disposal Pits.

All required data from the installation of wells and borings, sampling of surface water, ground water, soils and sediment, and chemical analyses were entered into computer files in the USATHAMA Tier 1 file format.

The lessons learned during this project occurred in two areas, the chemical analysis program and the geotechnical program. Revisions of particular note relating to chemical analysis are 1) HPLC methods for explosives, 2) preservation of NG and PETN samples, and 3) methods to determine the volume and type of liquid required for extracting samples from soils and sediments. Significant lessons learned about the geotechnical aspects of the project include 1) the modification of drilling procedures, practices, and equipment, 2) the value of geophysics as an investigatory tool, and 3) data management, retrieval and transmission methods.

The following conclusions have been determined from the results of the study:

1. Contamination migration has been found to be minimal at the Tooele Army Depot. Three areas of concern have been located through the collection and analysis of 36 soil and sediment samples and 30 surface- and ground-water samples. These areas are 1) Headquarters Area, consisting of the Industrial Waste Pond, Outfalls and ditches from the Maintenance Area, and the Sewage Lagoon, 2) TNT Washout Ponds/Laundry Ponds Area, and 3) the South Area arsenic problem.
2. A contaminated perched zone exists in the vicinity of the Industrial Waste Pond. Specific contaminants from this source have a high probability of migrating toward the Depot boundary and towards Depot water supply Well 2. Contaminants that exceed EPA standards are arsenic, nickel, chromium and lead. Contaminants that have been found to be anomalously high are zinc, chloride, fluoride, phosphate, sodium, 1,2-dichloroethane, trans-1,2-dichloroethene, tri-chloroethene, and possibly 2,4,6-trinitrotoluene. The travel time of ground water from this source to the north boundary of the Depot is approximately 55 years. This source remains active.
3. Contaminated water from the Industrial Waste Pond has probably entered fractures and solution channels in the underlying carbonate bedrock above the regional water table. If this contamination is extensive, it could provide a long-term source of contamination to the alluvial aquifer by slow drainage. The geometry and the impact of this contamination has not been assessed under this Exploratory Stage study.

4. The impact of seepage to the water table of possibly contaminated water from Outfalls B through E remains unknown.
5. A ground-water mound has built up beneath the Sewage Lagoon. This water is flowing toward the north Depot boundary and toward Depot water supply Wells 1 and 2. While no contaminants were found to exceed EPA standards in the one well that taps this perched zone, several contaminants approach EPA standards. These are nickel and nitrates. In addition, anomalously high levels of zinc, chloride, fluoride, sulfate, gross beta, sodium, and trichloroethene were found. Travel time for these contaminants to reach the north boundary is on the order of 55 years.
6. A perched water table exists below the TNT Washout Pond/Laundry Effluent Pond Area. Seepage of laundry effluent through soils contaminated with explosives from TNT Washout operations is a continuing mechanism for carrying contaminants to the ground water.
7. Ground water in the regional aquifer beneath the TNT Washout Ponds is contaminated with RDX and explosive derivatives, such as nitrates which are 6 times the EPA and Utah standards. While this ground water is contaminated, it is conservatively estimated that it would take 125 years to reach the north boundary.
8. DNT and TNT have migrated at least 45 feet down through the soil beneath the contaminated area surrounding the TNT Washout Ponds. A slug of RDX has currently migrated to 100 feet.

9. The areal extent of explosives contamination in the surface soil around the TNT Washout Pond Area has not been determined under this Exploratory Study.
10. No evidence has been found that contamination is being carried past the North Area boundaries by surface water.
11. Based upon the sampling point intercepting ground-water flow from the contaminated areas, contaminated ground water is not moving past this portion of the north boundary. All ground-water flow exits the Depot across the north boundary.
12. The South Area is generally clear of contamination except for arsenic.
13. Arsenic contamination above EPA and Utah water quality standards is present at the southern boundary of the South Area and is moving off-post because ground water movement is to the south and southwest. The source of this contamination cannot be defined with available data, but may be related to possible spills of arsenic-containing agents such as lewisite.

Ertec has developed three priority levels for recommendations for future work. First priority recommendations include design and execution of a monitoring program for existing wells to establish RCRA monitoring and provide additional information on specific contamination flow direction, velocity, magnitude and extent. Additional recommendations deal with the Headquarters problem area as the most critical for further study. Second priority recommendations have been made to cover USATHAMA's Confirmatory Stage action. Five new wells and two borings

are recommended to monitor the Headquarters Area and TNT Washout Area, along with coring of the TNT Washout Area. Collection and analysis of surface soil and sediment samples in the South Area are recommended to better determine the extent and origin of arsenic in the area. Third priority recommendations provide additional contaminant migration and hydrogeological information. These consist of drilling three wells and several bedrock cores.

I. OBJECTIVE

Determine if contaminants are or have the potential of migrating across TEAD boundaries via surface or subsurface pathways.

II. PHASE I

A. Approach

1. Use of existing data:
 - o Past Studies
 - o Field Visits
 - o Interviews
2. Contamination matrix was constructed that related 100 potential contaminants to 86 potential sources.

B. Results

1. Preliminary assessment of hydrogeologic system.
Ground-water system the least well-known.
 - o General directions of ground-water flow
 - o Recharge and discharge areas
 - o Significant subsurface features
2. Hazard Ranking System
 - o 19 sources singled outExamples:
 - o Industrial Waste Pond and Ditches
 - o TNT Washout Area
 - o CAMDS
 - o Sewage Lagoon
 - o Craters
3. Exploration Network
 - o 24 New wells or borings
North-10; South-14
 - o 9 Surface soil sample sites
 - o 6 Surface water sample sites
 - o 7 Existing wells
 - o North Area sites
 - o South Area sites

III. PHASE II

A. Geophysics Program

- o Reasons - broad coverage, rapid, inexpensive
- o Site Clearance - magnetometer survey
- o Gravity - confirm or deny buried bedrock ridge
- o Seismic Refraction - confirm gravity results and refine bedrock configuration in Headquarters Area
- o Gravity and Seismic Surveys were used to locate wells for cost effectiveness
- o Electrical Resistivity - attempt to delineate shallow, contaminated ground water

B. Drilling Program

- o Sample downgradient of single or multiple sources
- o Sample subsurface soil where boring was "close" to source
- o Evaluate general geology above and immediately below the water table
- o Install wells so as to minimize contamination
- o 24 wells or borings ranging in depth from 65 to 700 ft

C. Sampling Program

- o Ground-water samples - RMA protocol used
North-11; South-13
- o Surface-water samples
North-3; South-3
- o Surface sediment samples
North-5; South-4
- o Subsurface soil samples
North-12 from N3A
South-S2-3
S8-5
S11-3
S1-4

D. Chemical Analysis Program

- o Performed by UBTL
- o Both qualitative and semi-quantitative certification
- o Compounds analyzed - 55 in water - 46 in soil
 - o Explosives
 - o Volatile and semi-volatile organic compounds such as solvents
 - o Commonly expected inorganic anions
 - o Alpha and Beta radioactivity
 - o Oil and grease
 - o Heavy metals
 - o Cyanide

- E. Safety Program
 - Field - Drilling and Sampling
 - Geophysics - Blast Test
 - Lab
- F. Data Management Program
 - o All data has been put on magnetic tape in USATHAMA format

IV. RESULTS OF PHASE II PROGRAM

- A. Both North and South Areas were found to be free of contamination at the sampled sites except for three areas - one in the south and two in the north.
- B. South Area
 - 1. Problem: High arsenic at southern boundary which exceeds EPA standards (in 4 wells S4-430, S5-166)
 - 2. Area is confined to the south and southwest part of the South Area. Total dissolved solids in this area are also higher than in NE part of area.
 - 3. Source - uncertain, but two possibilities exist
 - o Arsenic containing agents such as Lewisite which have been reported as stored at TEAD, but no reported spills, disposal, or leaks
 - o Naturally occurring arsenic
 - o Rocks in mountains to east contain arsenic
 - o Regional ground-water flow system would concentrate arsenic in this area
- C. North Area - Two problem areas - TNT Washout Ponds and Headquarters Area
 - 1. TNT Washout Area
 - o Problem:
 - o Explosives in subsurface soils
 - o NO_3 in deep aquifer is 6 times EPA standards NO_3 from degradation of TNT
 - o Target - North Boundary
 - Estimated travel time 125 years
 - 2. Headquarters Area
 - o Problems
 - o Contaminated ground water under Industrial Waste Pond. Contaminants above standards are As, Ni, Cr, Pb. Several other contaminants, including other metals, organic solvents and their degradation products are anomalously high.

- o Ground-water mound under sewage lagoon while not above EPA standards, NO₃ and Ni approach the standards in well N4
- o Bedrock high under Waste Pond
- o Targets
 - o North Boundary - travel time 55 years from first contamination
 - o Wells 1 and 2

3. Summary of Findings

E. Recommendations for further work - three levels of priority

1. Priority 1 Recommendations

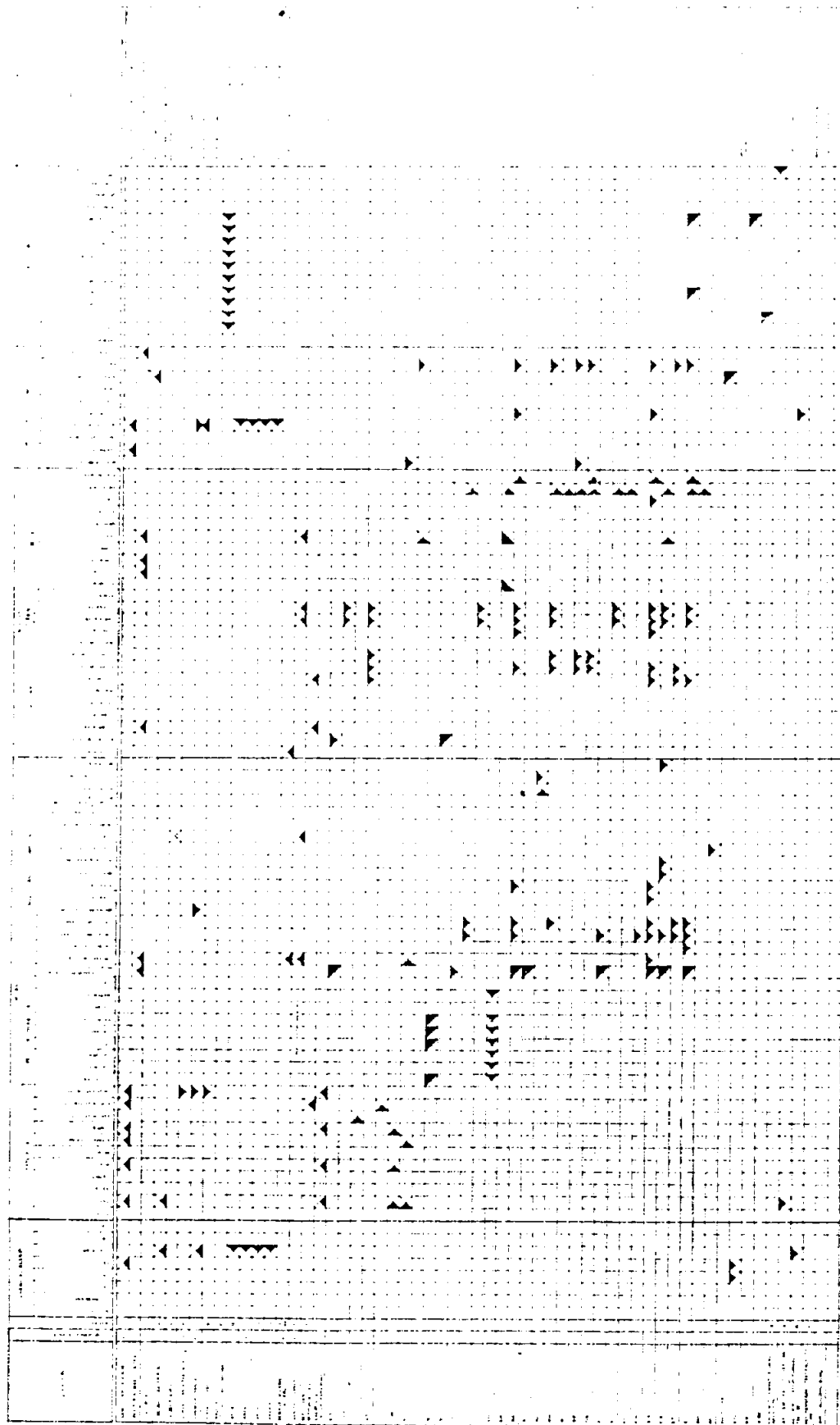
- o Ground water monitoring program for existing wells, including those installed during this study
- o Bacteriological survey on sewage lagoon and existing wells
- o Survey for nitrogenous compounds, sewage lagoon and wells
- o Water balance of the outfall area (also AEHA recommendation)

2. Priority 2 Recommendations

- o Install proposed wells 1, 2, 3
- o Sample soils in sewage lagoon
- o Install proposed wells 4 and 5
- o Soil sampling of TNT Washout Area
- o South Area soil and sediment sampling - Arsenic problem

3. Priority 3 Recommendations

- o Complete well N-7
- o Install well N-9
- o Redrill well N-6
- o Install wells between Sewage Lagoon and Waste Pond
- o Install downgradient wells from Sewage Lagoon and Waste Pond
- o Core bedrock under industrial waste pond
- o Assess the affects of different pumping rates of wells 1 and 2 on contaminant migration towards these wells



EXPLANATION

1. DIRECTION OF WIND
2. DIRECTION OF CURRENT
3. DIRECTION OF TIDE
4. DIRECTION OF FLOW

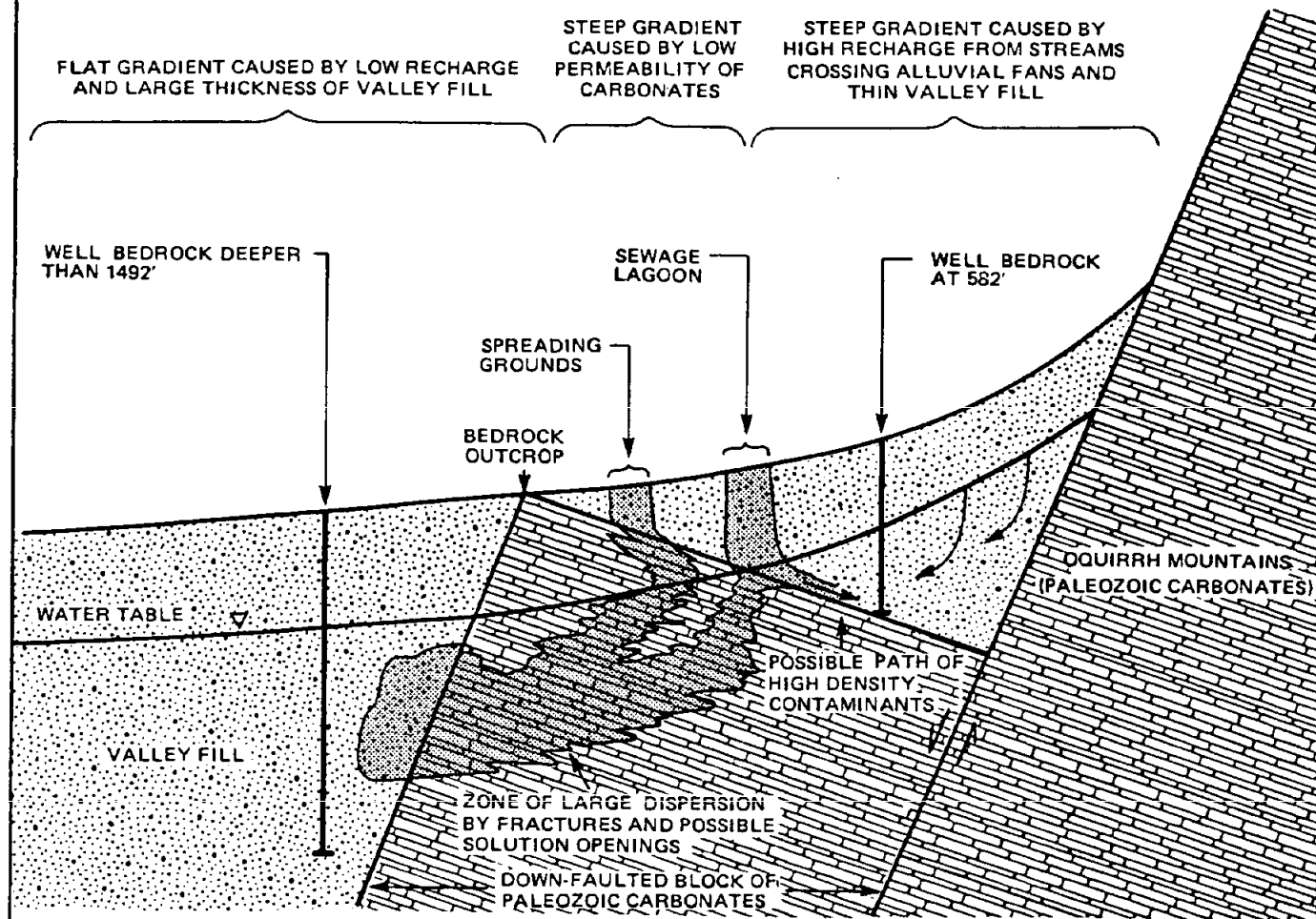
5. DIRECTION OF WIND
6. DIRECTION OF CURRENT
7. DIRECTION OF TIDE
8. DIRECTION OF FLOW

Approved by

Checked by

Drawn by

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|--|---------------------|
|  The Earth Technology Corporation | PROJECT NO.: 82-160 |
| | TOOELE ARMY DEPOT |

FIGURE 3
HYPOTHETICAL CROSS-SECTION A-A'
THROUGH NORTH AREA

11-81

TABLE 3 - Results of Ranking Procedures to Determine Potential for Ground Water Contamination, Tooele Army Depot.

| <u>Rank</u> | <u>Normalized Score (%)</u> | <u>Area(1)</u> | <u>Site(1)</u> | <u>Location</u> |
|-------------|---------------------------------|----------------|----------------|--|
| 1 | 78.6 | North | 2 | Industrial Waste Outfalls and Spreading Grounds Area |
| 2 | 64.3 | North | 17 | TNT Washout Ponds and Outfall |
| 3 | 44.4 | North | 15 | Sanitary landfill |
| 4 | 33.3 | North | 14A | Old Sewage Lagoon |
| 5 | 24.0 | South | 13 | CAMDS |
| 6 | 23.6 | North | 16 | Septic tank 56 from Building S-33 |
| 7 | 18.0 | South | 6,7 | Pond & Leach Pit, Bldg. T-600 |
| 8 | 11.1 | North | 14 | Sewage Lagoon |
| 9 | 9.9 | South | 2 | Gravel Pit (Area 10) |
| 10 | 8.8 | South | 1 | Demilitarization Area |
| 11 | 7.1 | North | 3 | Pond, Bldg. L-23 |
| 12 | 6.4 | North | 4 | Waste Water Pond, Bldg. 1303 |
| 13 | 5.4 | South | 28 | Craters, Southwest Area |
| 14 | 4.1 | South | 25 | Windrows |
| 15 | 4.0 | South | 22 | Holding Ponds, Bldg. 554 |
| 16 | 3.3 | South | 23 | Holding Area, Demilitarization Leakers |
| 17 | 3.3 | South | 4 | Pit (Area 2) |
| 18 | 2.4 | North | 7 | Chemical Range |
| 19 | 2.2 | South | 26 | Sanitary Landfill |

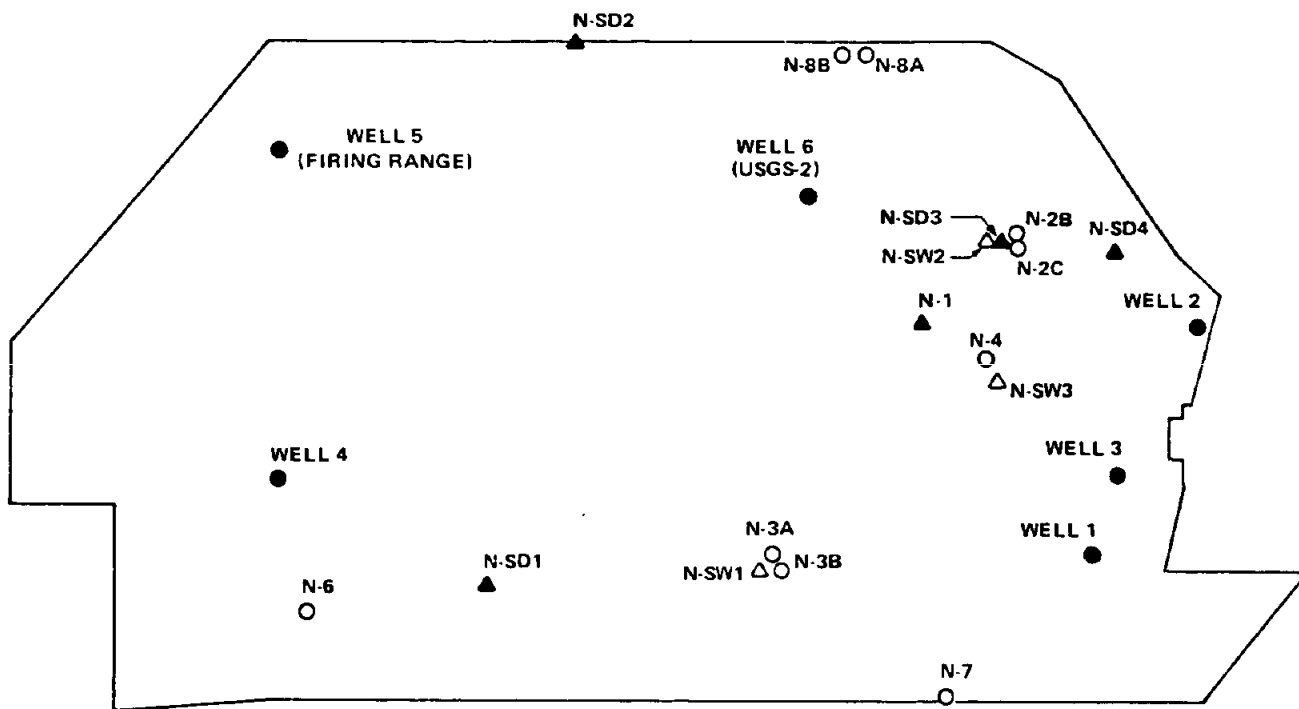
Below this line, normalized scores are less than 2% and therefore considered as insignificant problems and are not ranked.

| | | | | |
|----|-----|-------|----|---------------------------------------|
| -- | 1.7 | North | 20 | AEO Deactivation Furnace (1351-1357) |
| -- | 1.6 | North | 1 | Demolition Grounds |
| -- | 1.6 | South | 9 | Holding Area (near area 2) |
| -- | 1.1 | North | 5 | PCB Spill, K281 |
| -- | 1.0 | South | 8 | T3250/3251 and Associated Pits |
| -- | 0.8 | South | 3 | Leakers in Area 2 |
| -- | 0.7 | South | 24 | Old Demilitarization Shack and S-3200 |
| -- | 0.6 | North | 22 | Shell Bldg. |
| -- | 0.5 | South | 15 | C-4002 |
| -- | 0.4 | North | 8 | Firing Range |
| -- | 0.3 | South | 11 | Area 10 |
| -- | 0.3 | North | 6 | Surveillance Test Site |
| -- | 0.3 | South | 20 | S-541 |
| -- | 0.3 | South | 21 | Bldg. 553 |

Table 3 (Continued)

| Rank | Normalized Score (%) | Area ⁽¹⁾ | Site ⁽¹⁾ | Location |
|------|-------------------------|---------------------|---------------------|--|
| -- | 0.3 | North | 19 | AEO Demilitarization Facility (1370-1380) |
| -- | 0.3 | North | 21 | AEO Abandoned Test Facility |
| -- | 0.2 | South | 10 | Spill near Area 9 |
| -- | 0.1 | North | 18 | Radioactive Waste Storage Area S-753 |
| -- | 0.07 | North | 9 | Radioactive Storage Yard |
| -- | 0.05 | South | 27 | Gravel Pit |
| -- | 0.02 | South | 16 | S-119 |
| -- | 0 | South | 5 | Bldg. T-600 |
| -- | 0 | South | 12 | S-118 |
| -- | 0 | South | 14 | S-108 |
| -- | 0 | South | 17 | Bldg. 520 |
| -- | 0 | South | 18 | Bldg. 532 |
| -- | 0 | North | 10 | Area C |
| -- | 0 | North | 11 | Area G |
| -- | 0 | North | 12 | Area J |
| -- | 0 | North | 13 | Area K |
| -- | 0 | South | 19 | Bldg. 533 |

(1) Keyed to Plates II and V by area and site



EXPLANATION

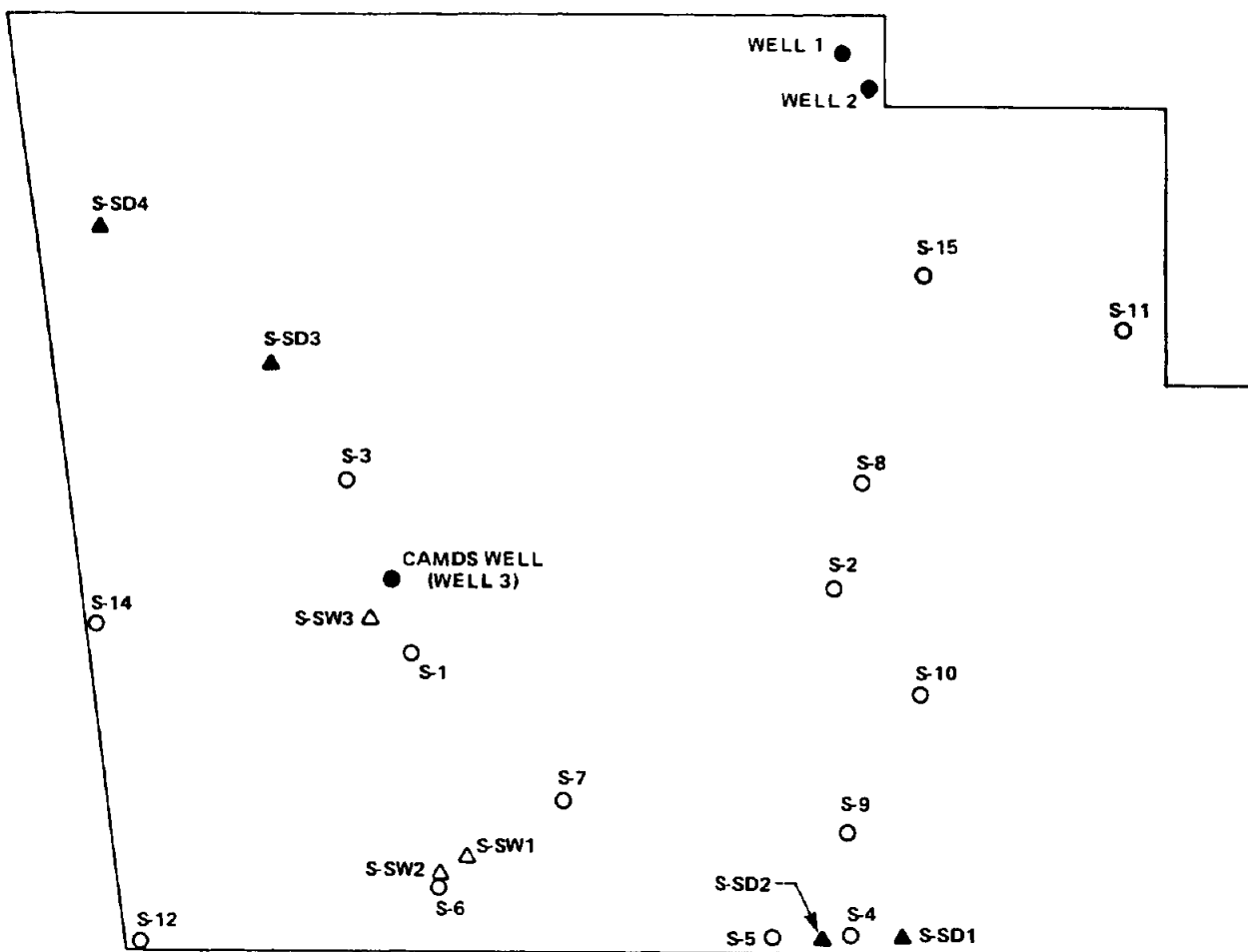
- △ SURFACE WATER SAMPLE LOCATION
- ▲ SEDIMENT SAMPLE LOCATION
- ERTEC WELL OR BORING LOCATION
- EXISTING WELL LOCATION



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TOOELE ARMY DEPOT

TOOELE NORTH AREA ACTIVITY MAP



EXPLANATION

- △ SURFACE WATER SAMPLE LOCATION
- ▲ SEDIMENT SAMPLE LOCATION
- ERTEC WELL OR BORING LOCATION
- EXISTING WELL LOCATION

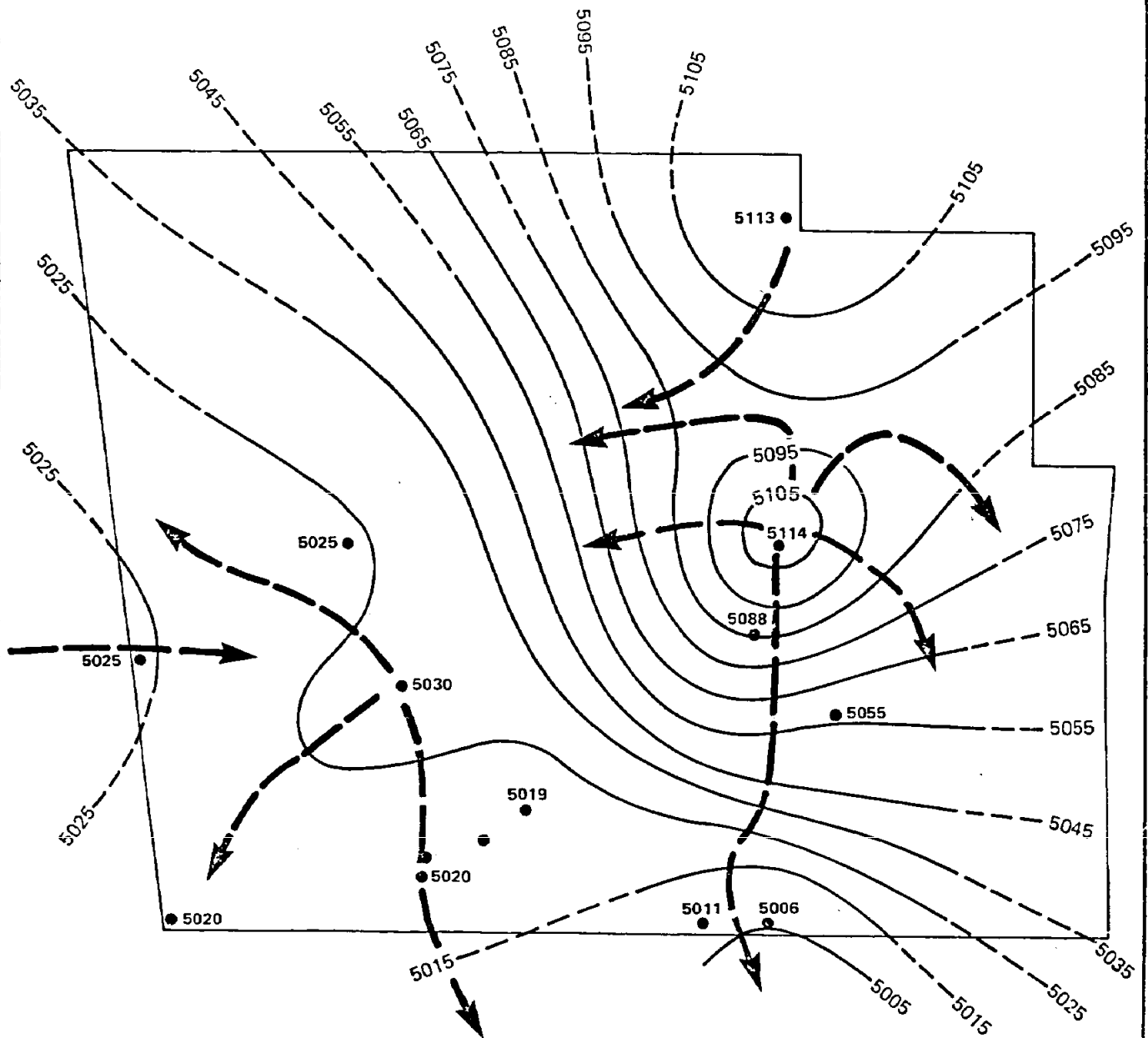


PROJECT NO.:

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TOOELE ARMY DEPOT

TOOELE SOUTH AREA ACTIVITY MAP



EXPLANATION

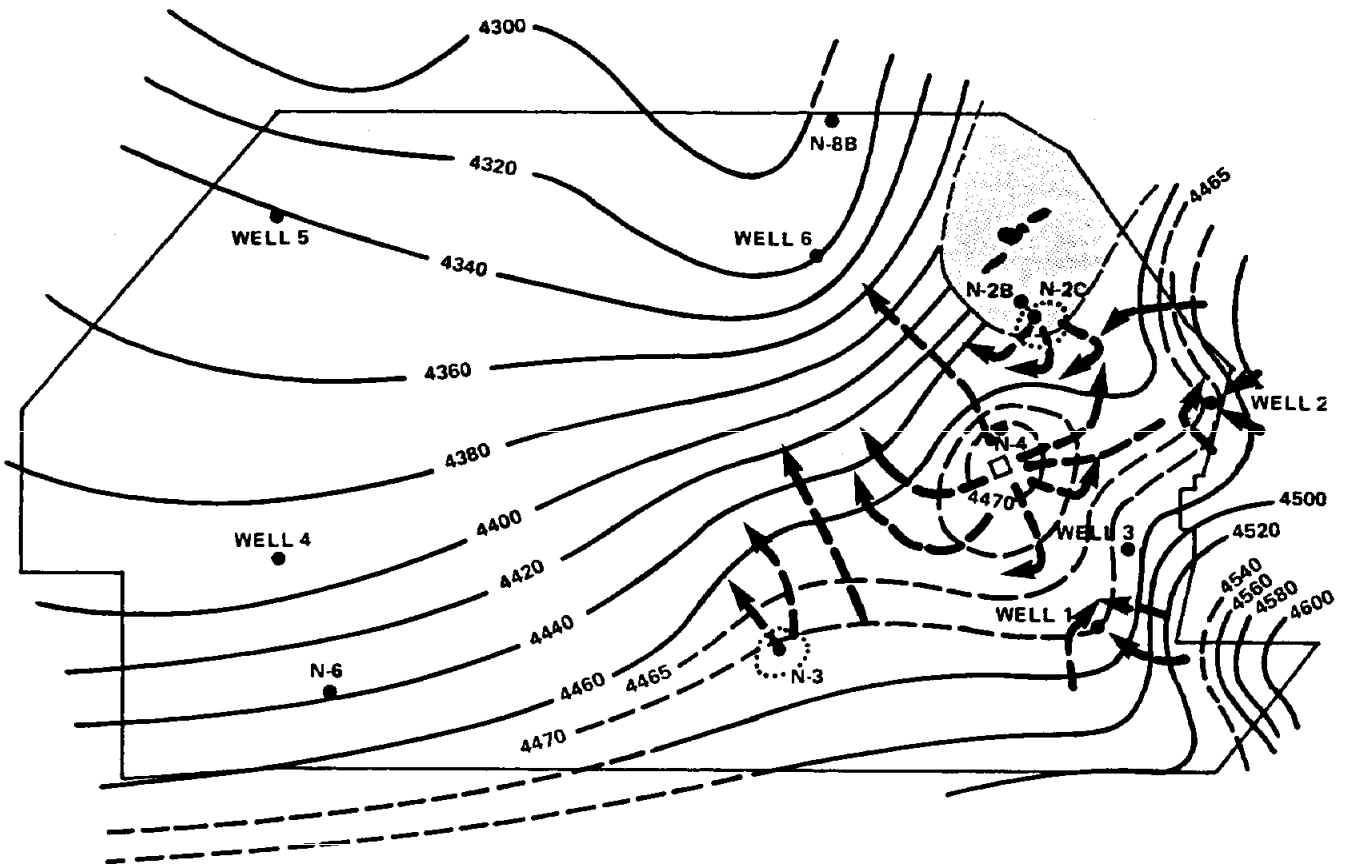
— 5075 WATER LEVEL ELEVATION, FEET
 - - - - - DIRECTION OF FLOW

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TOOELE ARMY DEPOT

SOUTH AREA POTENTIOMETRIC
 SURFACE AND REPRESENTATIVE
 FLOW LINES



PERCHED WATER



PALEOZOIC CARBONATES ABOVE THE WATER TABLE

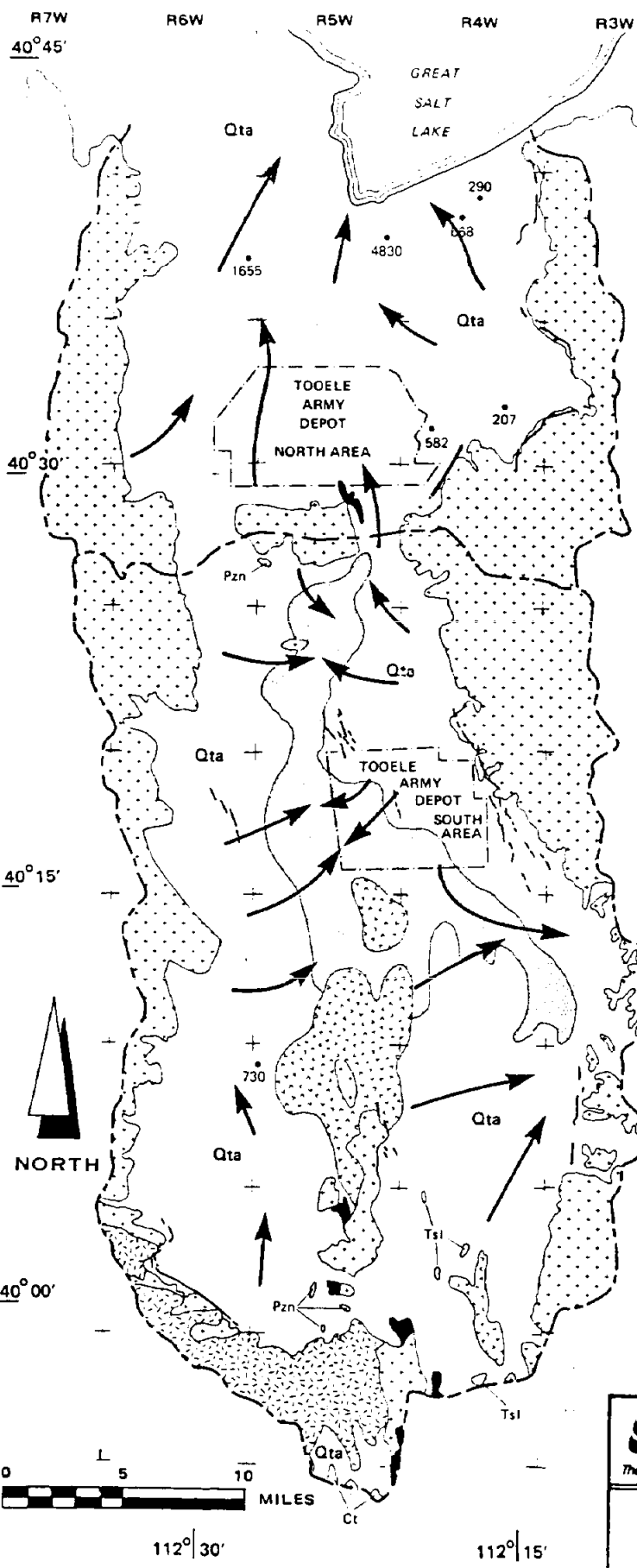


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TOOELE ARMY DEPOT

NORTH AREA POTENTIOMETRIC
SURFACE AND REPRESENTATIVE
FLOW LINES

9-82



EXPLANATION

- T1S --- BOUNDARY OF DRAINAGE BASIN
- T2S SUSPECTED FAULT SCARPS IN UNCONSOLIDATED DEPOSITS
- T3S Qta ALLUVIAL DEPOSITS - CLAY, SAND, AND GRAVEL MODERATE TO HIGH PERMEABILITY
- T4S Qlc LAKE SEDIMENTS - CLAYS, SLIGHTLY SALINE LOW TO MODERATE PERMEABILITY
- T5S Tsl SALT LAKE FORMATION - CONTINENTAL SANDSTONE, CLAYSTONE, LIMESTONE AND TUFF, LOW PERMEABILITY
- T6S Tig IGNEOUS ROCKS - RHYOLITE, DACITE, LATE FLOWS, LOW PERMEABILITY
- T7S Pzn PALEOZOIC SEDIMENTARY ROCKS, CHIEFLY CARBONATES, GENERALLY LOW PERMEABILITY, LOCALLY HIGH ALONG JOINTS, FAULTS, ETC.
- T8S Ct TINTIC QUARTZITE - LOW PERMEABILITY EXCEPT HIGH ALONG FAULTS, FRACTURES, ETC.
- T9S

DATA COMPILED FROM:

RUSH VALLEY - HOOD, AND OTHERS, 1969
 TOOEE VALLEY - MOORE AND SORESENSEN, 1979
 QUATERNARY FAULTS - BUCKNAM, 1977

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PROJECT NO.: P81-470

TOOELE ARMY DEPOT

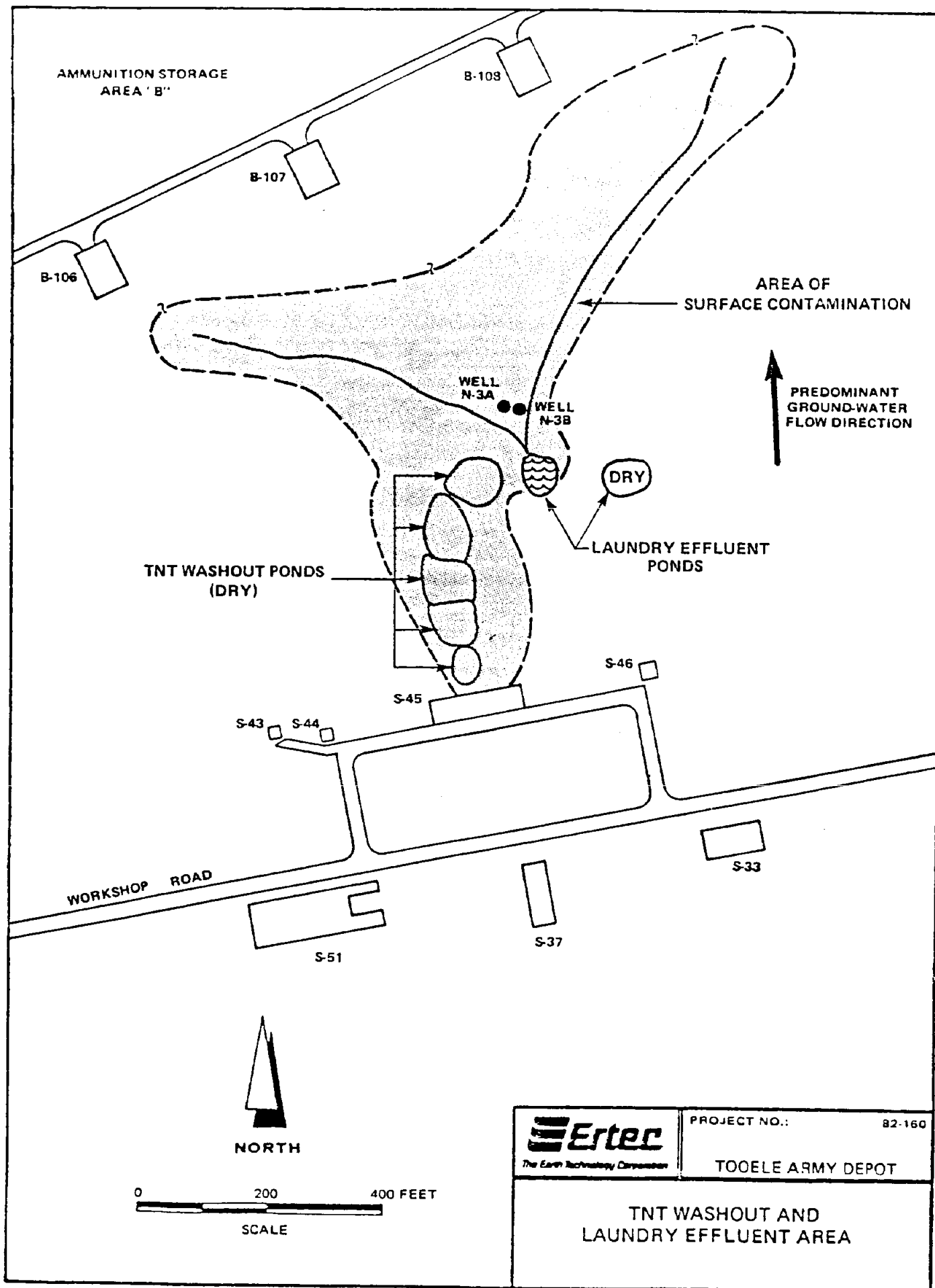
GENERALIZED GEOLOGY,
 TOOEE AND RUSH VALLEYS, UTAH

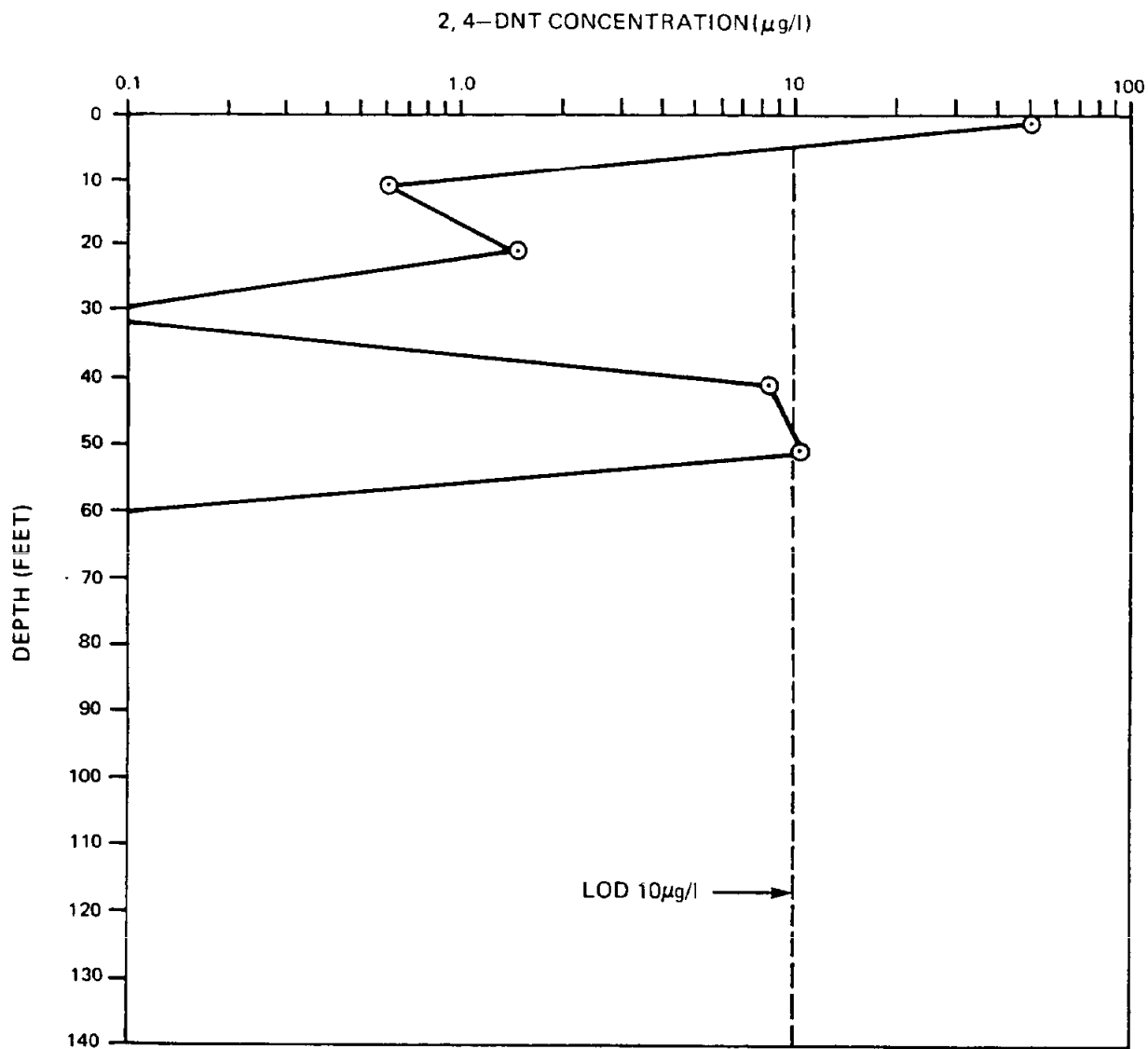
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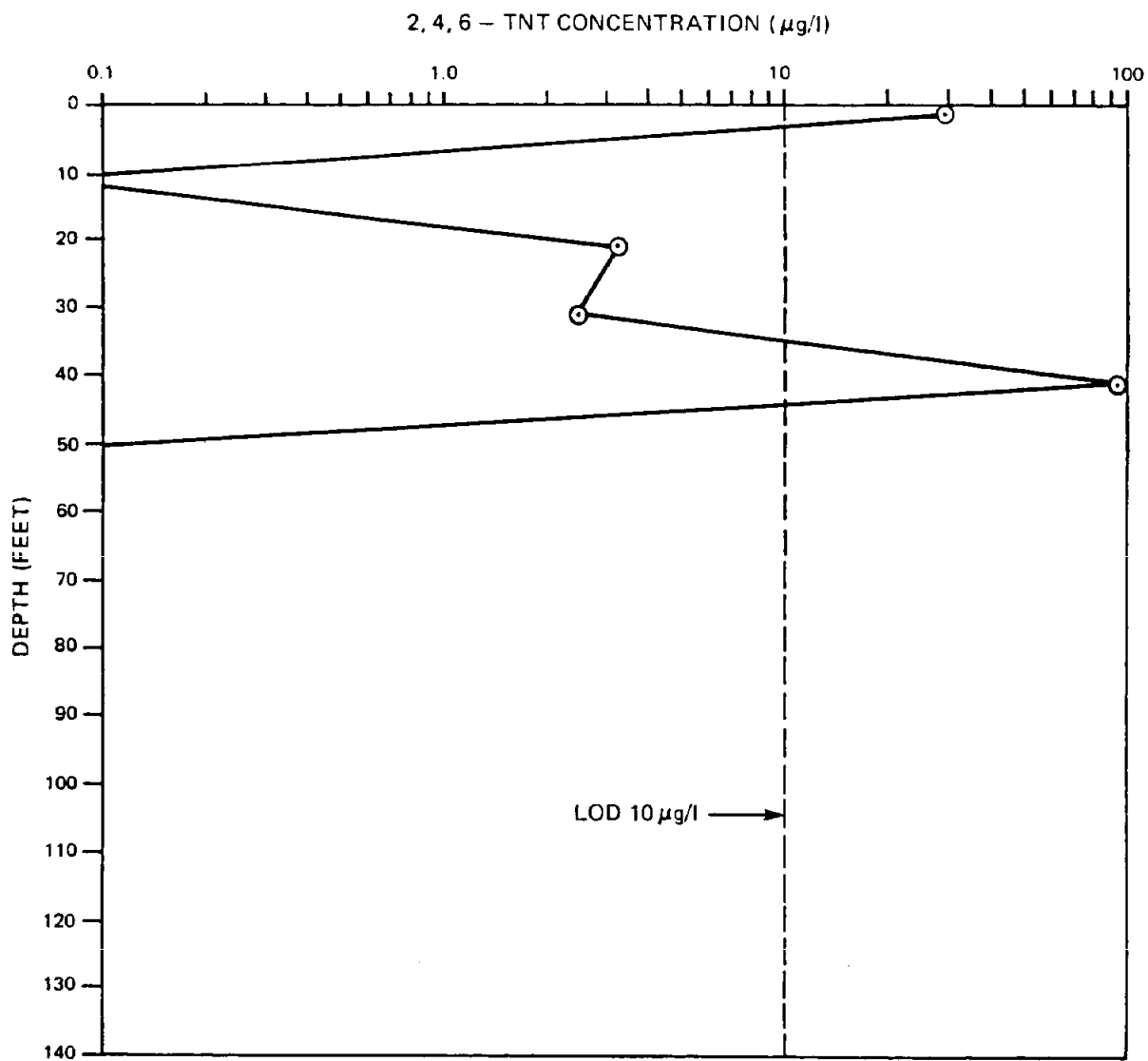


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TOOELE ARMY DEPOT

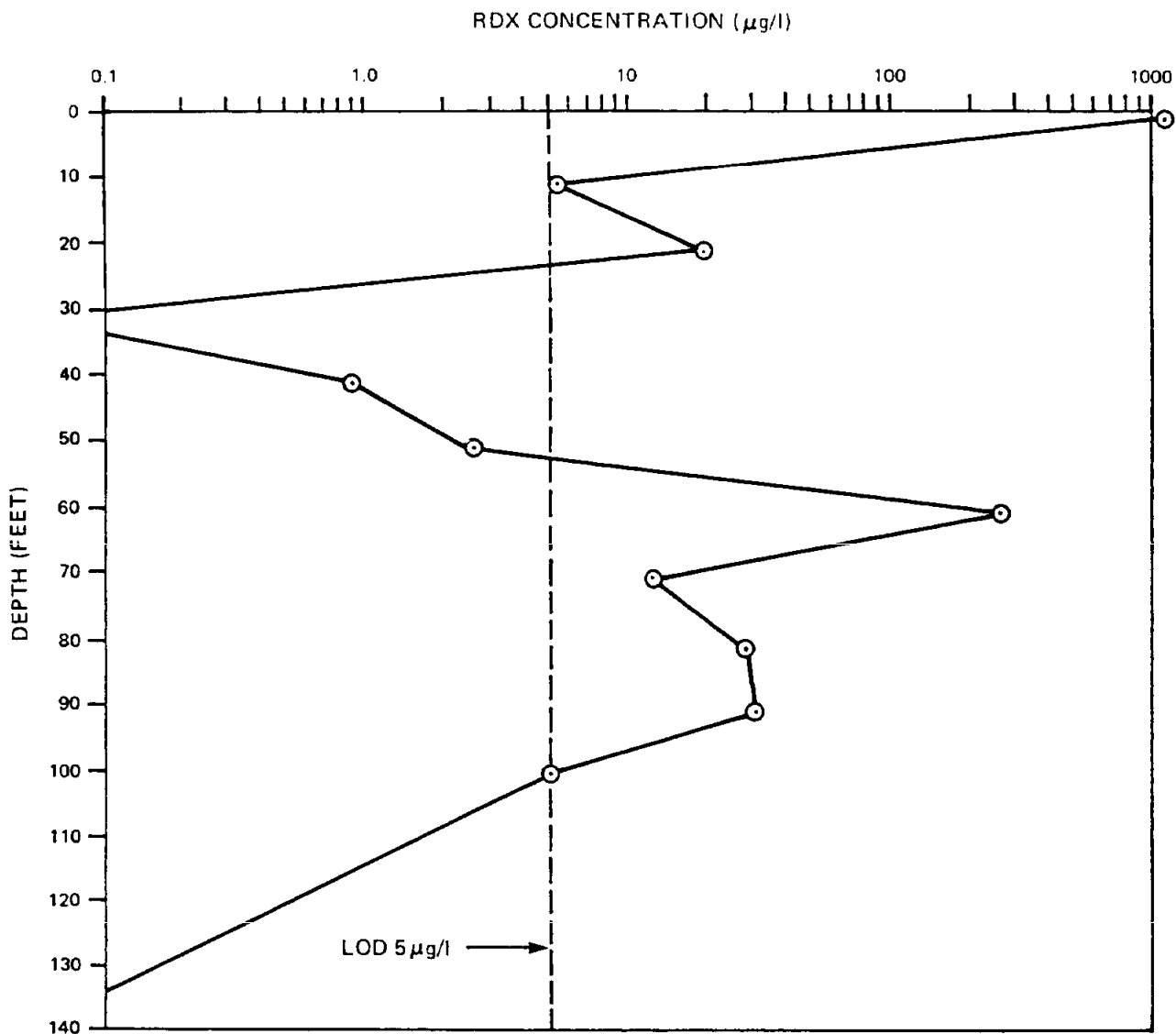
PLOT OF 2, 4 - DNT CONCENTRATION
VERSUS DEPTH FOR SOIL SAMPLES
TAKEN FROM WELL N-3A



PROJECT NO.: 82-160

TOOELE ARMY DEPOT

PLOT OF 2, 4, 6 - TNT CONCENTRATION
VERSUS DEPTH FOR SOIL SAMPLES
TAKEN FROM WELL N-3A

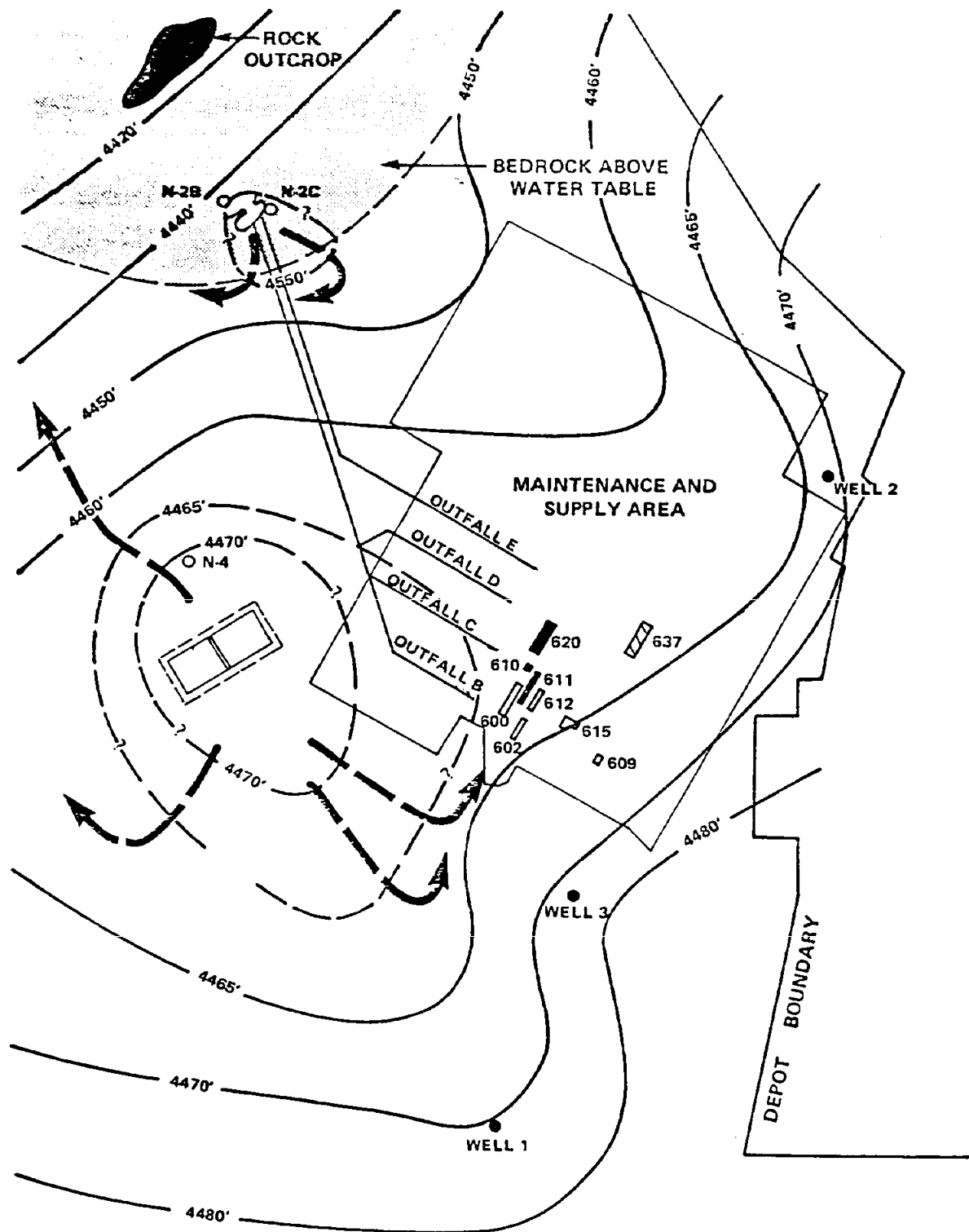


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TOOELE ARMY DEPOT

PLOT OF RDX CONCENTRATION
VERSUS DEPTH FOR SOIL SAMPLES
TAKEN FROM WELL N-3A



BUILDINGS

-  TO LINE B
-  TO LINE C
-  TO LINES D & E

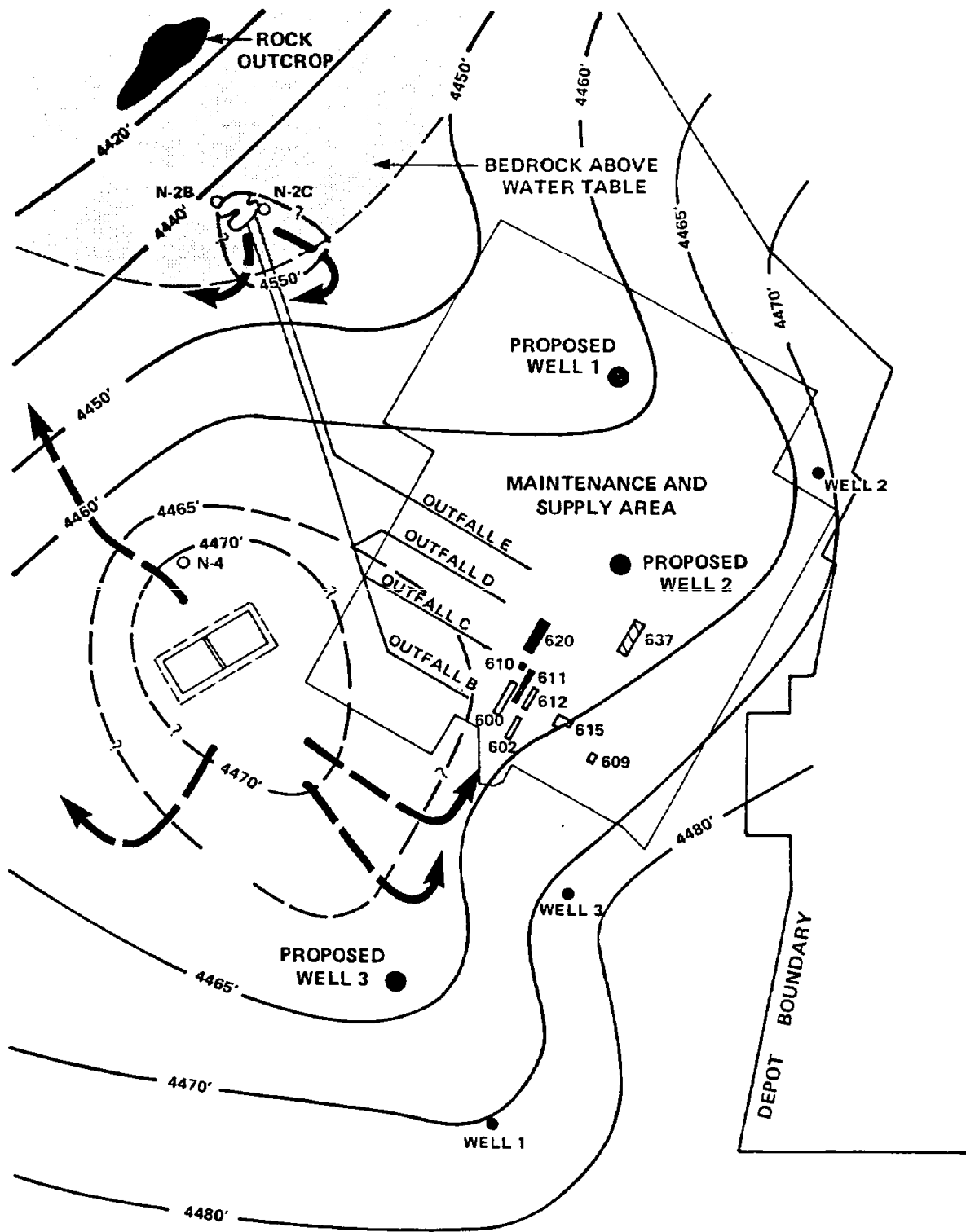


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


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TOOELE ARMY DEPOT

HEADQUARTERS AREA SHOWING
INDUSTRIAL WASTE PONDS,
OUTFALLS, AND SEWAGE LAGOON



BUILDINGS

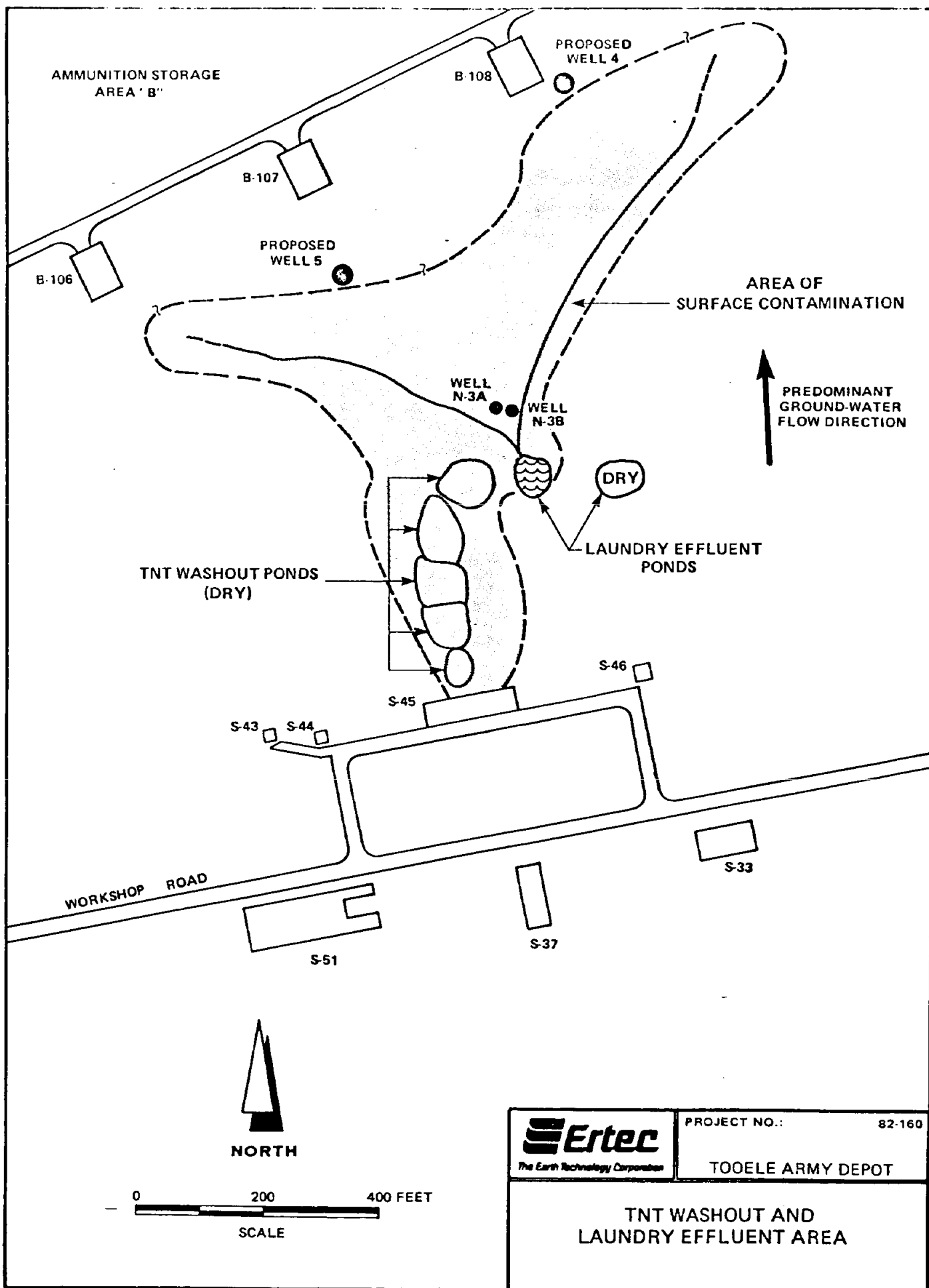
-  TO LINE B
-  TO LINE C
-  TO LINES D & E



PROJECT NO.: 82-160

TOOELE ARMY DEPOT

HEADQUARTERS AREA SHOWING
INDUSTRIAL WASTE PONDS,
OUTFALLS, AND SEWAGE LAGOON



7.0 CONCLUSIONS

To determine whether toxic or hazardous materials are migrating or have the potential to migrate off Tooele Army Depot property, Ertec has conducted the Exploratory Stage of a contamination survey at the Depot. The results of the Study have been used to 1) detect possible contaminants crossing the boundary, 2) determine if any contaminated areas within the installation are presenting an imminent hazard to the off-post environment or to personnel working on-post, 3) determine background levels of possible contaminants, 4) define general stratigraphical and lithological relationships, and 5) characterize the general hydrologic system. The following conclusions have been determined from these results.

1. Contamination migration has been found to be minimal at the Tooele Army Depot. Three areas of concern have been located through the collection and analysis of 36 soil and sediment samples and 30 surface- and ground-water samples. These areas are 1) Headquarters Area, consisting of the Industrial Waste Pond, Outfalls and ditches from the Maintenance Area, and the Sewage Lagoon, 2) TNT Washout Ponds/Laundry Ponds Area, and 3) the South Area arsenic problem.
2. A contaminated perched zone exists in the vicinity of the Industrial Waste Pond. Specific contaminants from this source have a high probability of migrating toward the Depot boundary and towards Depot water supply Well 2. Contaminants that exceed EPA standards are arsenic, nickel, chromium and lead. Contaminants that have been found to be anomalously high are zinc, chloride, fluoride, phosphate,

sodium, 1,2-dichloroethane, trans-1,2-dichloroethene, tri-chloroethene, and possibly 2,4,6-trinitrotoluene. The travel time of ground water from this source to the north boundary of the Depot is approximately 55 years. This source remains active.

3. Contaminated water from the Industrial Waste Pond has probably entered fractures and solution channels in the underlying carbonate bedrock above the regional water table. If this contamination is extensive, it could provide a long-term source of contamination to the alluvial aquifer by slow drainage. The geometry and the impact of this contamination has not been assessed under this Exploratory Stage study.
4. The impact of seepage to the water table of possibly contaminated water from Outfalls B through E remains unknown.
5. A ground-water mound has built up beneath the Sewage Lagoon. This water is flowing toward the north Depot boundary and toward Depot water supply Wells 1 and 2. While no contaminants were found to exceed EPA standards in the one well that taps this perched zone, several contaminants approach EPA standards. These are nickel and nitrates. In addition, anomalously high levels of zinc, chloride, fluoride, sulfate, gross beta, sodium, and trichloroethene were found. Travel time for these contaminants to reach the north boundary is on the order of 55 years.
6. A perched water table exists below the TNT Washout Pond/Laundry Effluent Pond Area. Seepage of laundry effluent through soils contaminated with explosives from TNT Washout operations is a continuing mechanism for carrying contaminants to the ground water.

7. Ground water in the regional aquifer beneath the TNT Washout Ponds is contaminated with RDX and explosive derivatives, such as nitrates which are 6 times the EPA and Utah standards. While this ground water is contaminated, it is conservatively estimated that it would take 125 years to reach the north boundary.
8. DNT and TNT have migrated at least 45 feet down through the soil beneath the contaminated area surrounding the TNT Washout Ponds. A slug of RDX has currently migrated to 100 feet.
9. The areal extent of explosives contamination in the surface soil around the TNT Washout Pond Area has not been determined under this Exploratory Study.
10. No evidence has been found that contamination is being carried past the North Area boundaries by surface water.
11. Based upon the sampling point intercepting ground-water flow from the contaminated areas, contaminated ground water is not moving past this portion of the north boundary. All ground-water flow exits the Depot across the north boundary.
12. The South Area is generally clear of contamination except for arsenic.
13. Arsenic contamination above EPA and Utah water quality standards is present at the southern boundary of the South Area and is moving off-post because ground water movement is to the south and southwest. The source of this contamination cannot be defined with available data, but may be related to possible spills of arsenic-containing agents such as lewisite.

8.0 RECOMMENDATIONS

There is substantial evidence that contaminants are migrating or have the potential to migrate off Depot property and that contaminants are migrating towards Depot water supply wells. To determine specific flow direction, velocity, magnitude and extent of these contaminant plumes, Ertec proposes the following recommendations. Relative priority levels have been established to better clarify the significance or degree of consideration to be given to each recommendation.

8.1 First Priority Recommendations

Ertec strongly advises that these first priority recommendations be followed. They are necessary to complete USATHAMA'S Exploratory Stage work at Tooele.

1. Ground water monitoring program.

A monitoring program should include sampling of all existing wells at the Tooele Army Depot on a semi-annual basis.

Analysis will be based on those contaminants found in the ground water above the LOD, in addition to those deemed necessary by state and federal agencies to fulfill the requirements of the Resource Conservation and Recovery Act (RCRA) as described in 40 CFR Parts 260-267. The well system currently established at TEAD should suffice, perhaps with minor modification and upon negotiation with the agencies involved, as a monitoring program "capable of determining the facility's impact on the quality of ground water" underlying the facility (40CFR Part 265.90). In addition, the monitoring system should include proper procedures and techniques for sample collection,

sample preservation and shipment, analytical procedures, and chain of custody control. These have been described in detail in Ertec's Technical Plan submitted to USATHAMA in September, 1981.

2. Bacteriological survey.

The Sewage Lagoon, Well N-4, and existing Wells 1, 2, and 3 in the TEAD North Area should be sampled and analyzed for fecal coliform and other indicator bacteria to determine the migration potential of these constituents. This information is also used to determine the potential impact of the sewage lagoon.

3. Nitrogenous compounds study.

The Sewage Lagoon, Well N-4, and existing Wells 1, 2, and 3 should be sampled and analyzed for nitrates, nitrites, total organic nitrogen, Kjeldahl nitrogen, and ammonia to help determine potential impact of the Sewage Lagoon.

4. Outfalls water balance study.

Recording gauges should be installed to monitor the effluent from the outfalls and the amount reaching the Industrial Waste Pond. From this data, a water balance and ground-water mounding calculation should be made to determine the impact of water loss along the ditches to the Industrial Waste Pond. This information should be included in the hydrogeological interpretation of the North Area and the Potentiometric Head Map should be redrawn. This will aid in determining the seriousness of potential impact to existing Well 2.

8.2 Second Priority Recommendations

These recommendations should be followed as part of USATHAMA's Confirmatory Stage for the Tooele Army Depot.

1. Install proposed Wells 1, 2, and 3.

These wells (shown on Figure L) are necessary to provide information on the degree of contamination and shape of the contaminant plumes caused by seepage from the Industrial Waste Pond and Sewage Lagoon. These wells also act as outpost wells for an early warning of contamination approaching existing water supply Wells 1 and 2. The bacteriological and nitrogenous compound sampling and analysis are also included for these wells.

2. Sewage lagoon soil samples.

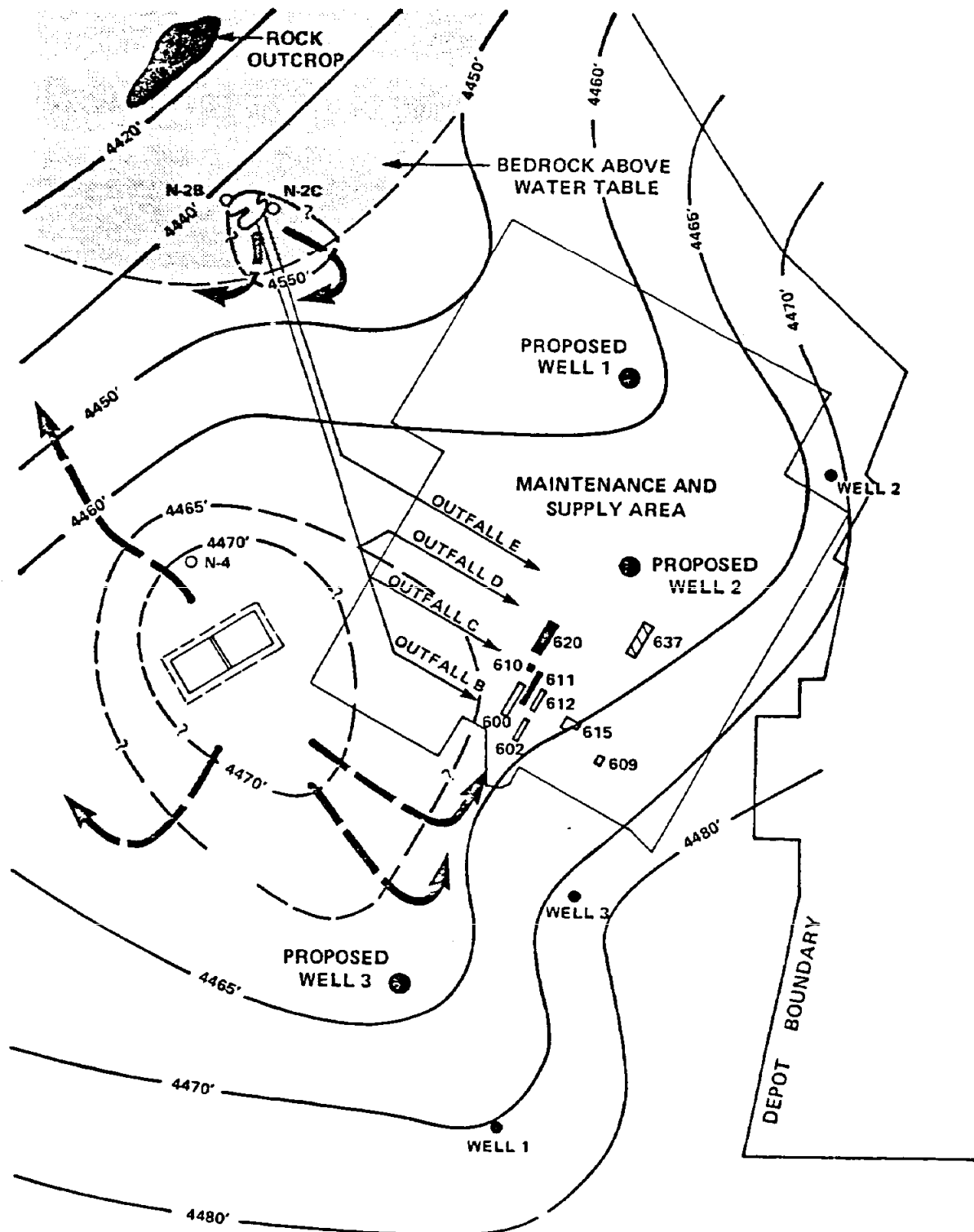
Two borings, located in the northeast and southeast sides of the sewage lagoon, should be drilled to a depth of approximately 80 feet and sampled for nitrogenous compounds and nickel, to determine the magnitude and extent of contamination of these substances.

3. Install proposed Wells 4 and 5.




Two wells should be drilled to the north of the TNT contamination area, as shown on Figure U to determine the extent of explosives contamination caused by the TNT washout and laundry operations. Only a limited number of analyses need be obtained for these wells.


4. Soil sampling of TNT area.

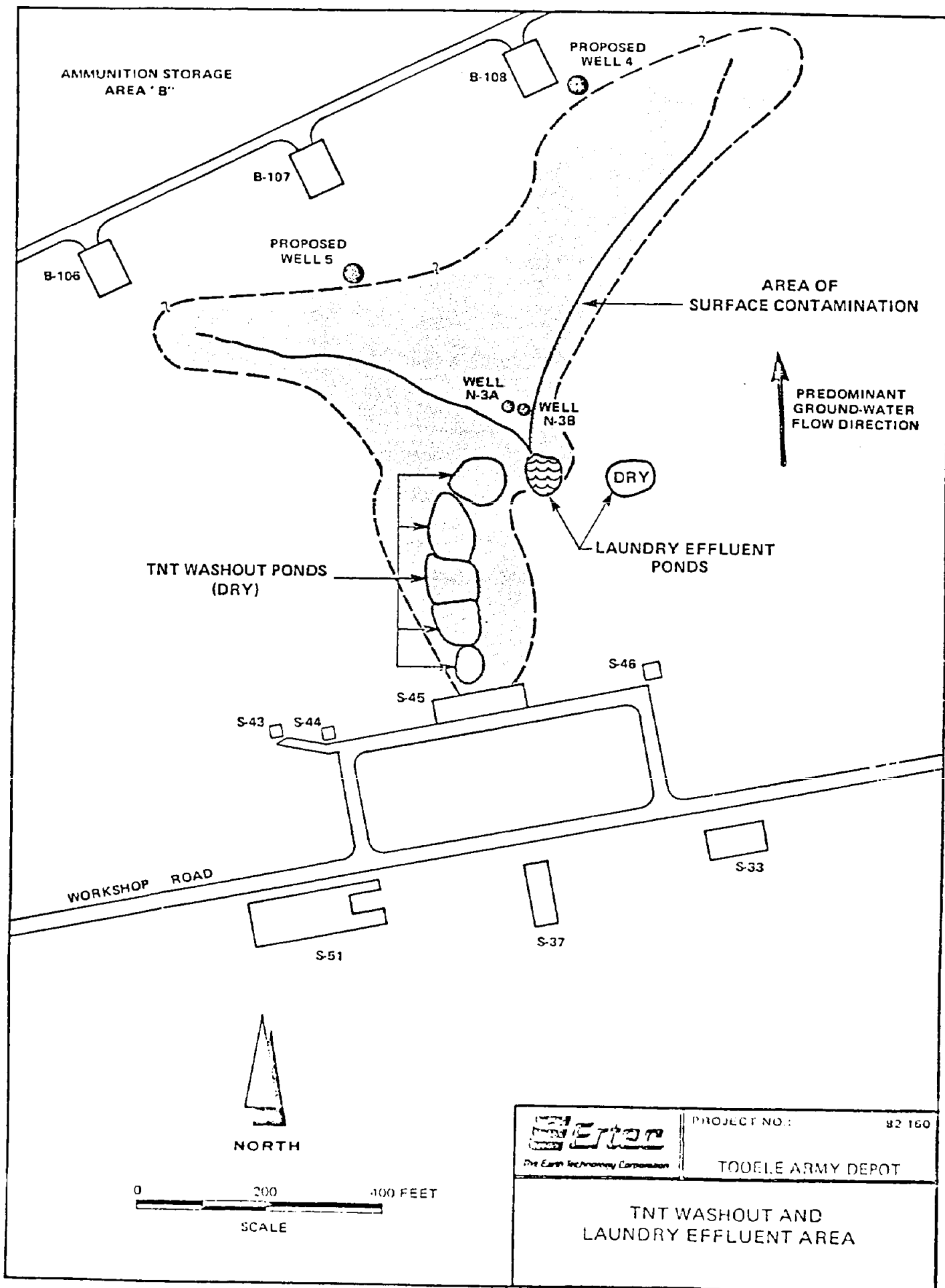
A maximum of ten five-foot cores should be taken within the explosives-contaminated area, including the TNT Washout Ponds. Each 6-inch interval should be analyzed, as a separate sample, for explosives in question.



BUILDINGS

-  TO LINE B
-  TO LINE C
-  TO LINES D & E

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5. South Area sediment sampling.

A maximum of ten surface soil and sediment samples should be obtained from the south-central portion of the South Area and analyzed for arsenic. The majority of these samples should be obtained from the Demilitarization Area/Demolition Pits. This will supply additional information for determining the origin of arsenic in this area. Additional reconnaissance should be undertaken to determine the possibility of arsenic contamination originating from off-site sources. Additional sediment samples may be collected and analyzed for arsenic.

8.3 Third Priority Recommendations

Ertec suggests the following recommendations to obtain additional information on potential contaminant migration and hydrogeological conditions.

1. Complete Well N-7.

This well can provide information to determine if any contaminants are migrating onto the site. It may be required by RCRA as an up-gradient sampling point for measuring background ground-water conditions. A surface soil sample should also be collected and analyzed at this point to determine contamination carried onto the Depot by surface run-off.

2. Install Well N-9.

This well provides information at the boundary in the area immediately up-gradient of the nearest off-base well. It may intercept past contamination plumes from sources such as the TNT and laundry area.

3. Re-drill Well N-6.

Information on the Chemical Range can be obtained by re-drilling Well N-6 or completing a new well in a slightly different location.

4. Bedrock coring.

At least three 20 to 40 foot cores of the bedrock in the near vicinity of the Industrial Waste Pond should be obtained for chemical and physical analysis to determine potential for long-term contamination of the bedrock.

5. Ground-water withdrawal assessment of Headquarters Area.

A ground-water withdrawal assessment of the Headquarters Area would be extremely useful in determining the impact of pumpage of existing Wells 1 and 2 on the movement of the contaminant plumes from the Industrial Waste Pond, Outfalls ditches, and Sewage Lagoon.